Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	}	
	}	
Revision of Part 15 Rules of the Commission's	}	
Rules Regarding Ultra-Wideband	}	ET Docket No. 98-153
Transmission Systems	}	

Reply Comments of Gary R. Olhoeft, PhD

Gary R. Olhoeft, PhD, submits these additional reply comments in response to the Notice of Proposed Rule Making (NPRM), FCC 00-163, and the request for comments on testing (performed by NTIA and others) in the proceeding referenced above. These comments address the most recent submissions provided to the FCC under this docket, including recommendations and conclusions made in submissions by others suggesting continued rule making in this proceeding and proposed changes to Part 15 rules.

With regard to geophysical electromagnetic broadband and ultrawideband (UWB) measurement devices (such as ground penetrating radar, GPR), I have already commented that the test measurements to date are either incomplete or flawed (especially with regard to understanding and testing the normal deployment and use of geophysical equipment), and the resulting conclusions and recommendations reflect those problems. For electromagnetic geophysics, I would like to support the FCC's proposal of 10 May 2000 to "…consider permitting the operation of ultra-wideband (UWB) technology on an unlicensed basis, which could have enormous benefits for public safety, consumers and business. UWB devices appear to be able to operate on spectrum already occupied by existing radio services without raising interference." I have already commented on the public health and safety (and other) benefits of applying this proposal to electromagnetic geophysical investigations and the necessity to perform such investigations at frequencies below 3.1 GHz.

This comment replies to the comment of Dr. Robert Fontana that "To date the geophysical community has not demonstrated the need to manufacture and sell such devices on an unlicensed basis." Not only has the need been demonstrated, but such devices have been commercially manufactured, sold and used to solve real world problems for more than 30 years, and in the case of particular methods for more than 50 years on an unlicensed basis. Further, in my 34 years of using such devices, I know of no problems of interference caused by the geophysical equipment in proper use (although the reverse is certainly a problem).

I'll use one particular type of geophysical equipment to provide an example, commercial short pulse ground penetrating radar (GPR) systems, as these were the only examples of geophysical equipment used in the recent NTIA tests. These instruments can operate in frequency from roughly 10 MHz to 3,000 MHz and yet are extremely unlikely to produce interference with other devices, and I know of no cases of interference by these commercial systems. These systems should not and do not produce interference because they are 1) extremely **low power output** (much less than a typical cell phone), 2) **low pulse repetition frequency** (PRF less than 100 kHz), 3) **low duty cycle** (transmit for a short time and passively receive reflections for a large multiple of the transmit time, that multiple often in the 1000's), 4) **low use cycle** (they are often on for only a few minutes and then off for tens of minutes to hours while the user changes logistical deployment, location, or analyzes the results). Further, there are 5) only a **few thousand of these units** in use in total in the world (and I've seen a dozen in use at the same time within a few tens of meters of each other during training or demonstrations without interference with each other), 6) to maximize their intended use, they are **designed to couple their energy into the ground** (sometimes imperfectly, but whatever gets into the air comes back as reflections or multipathing that interferes with the measurement and is thus to be minimized), and 7) nearly all of them are designed to take data while moving (along traverse profiles) using distance wheels to keep track of where they are along the traverse. They are only on to make a measurement when the wheel indicates they have moved a certain interval of distance, so **when they are not moving they are automatically off**. In the latter case, many newer systems replace the distance wheel by a GPS unit for the same purpose, and it is a requirement of the geophysical measurement to know where the instrument is or the data are useless, and thus there is incentive to not interfere at short range with the GPS receiver. I'll leave the manufacturers of these instruments to file details of specific numbers of instruments, power and bandwidth, modes and methods of usage, and so forth if necessary and desired.

Any system designed to comply with Part 15 Rules can be made to violate them (like when a user removes the case cover from a personal computer to install a new accessory, and then tests it with the cover off). In the case of the NTIA and other recently reported test results, few ground penetrating radar systems were tested, and their test results received little comment, but they look favorable in terms of producing interference. This is true even though the test setups violated some of the above tenets, especially as regards intended and typical use of such systems, and the testing ignored or violated ground coupling, polarization, and deployment issues. When these issues are properly considered, the results will be even more favorable.

I have used GPR systems with the GPR antenna coupled to the ground and the GPS receiver mounted on the GPR antenna (GPR pointed down, GPS pointed up) within one meter of each other without interference to the GPS. I have used GPR along airport runways with active aircraft operations so that use of the GPR was timed to avoid interference to the GPR from avionics, and I know of no cases where the GPR interfered with the aircraft operations. I know of one case where a GPR was used on a commercial airport operation and suspected of causing communications interference, but because the GPR date and time stamped the data as it was in operation, it was later proven not to have been taking data when the interference occurred, and the GPR system was thus exonerated of causing the interference. I propose the FCC continue to allow unlicensed electromagnetic geophysical investigation activities or to specifically exempt such activities from licensing requirements as long as they can continue to be performed without interference to other devices and services.

Beyond this example, the situation becomes more complicated when this scenario is extended to the whole range of possible electromagnetic geophysics. There are then a myriad of methods and devices, with wide ranges and modes of deployment, including electromagnetic induction (diffusion) and propagation modes, near field and far field, evanescent and plane wave, electric or magnetic dipole antennas (or both), multiple and variable transducer orientation and spacing, systems built in the thousands (like metal detectors) for common problems (like utility detection) to unique or few-of-a-kind systems costing hundreds of thousands of dollars each built or modified for specific problems (like characterizing a particular environmental problem in a unique geology). I doubt the FCC wants to become involved in the complications of licensing such systems, especially in the absence of any instances of interference. However, if licensing were to be further considered, I would recommend the FCC call on the resources of the U.S. Geological Survey to assist in the technical complications of electromagnetic geophysical exploration, as they have more experts in this area of electromagnetic geophysics than any other federal agency. More than anything, I want to avoid some regulatory change which has the unintended consequence of putting electromagnetic geophysics out of business.

Respectfully submitted,

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